May 20, 2008

M E M O R A N D U M

TO: Gregory Eager, P.E., Acting Regional Administrator, Idaho Falls Regional Office.

FROM: Charlie Mazzone, P.E., Staff Engineer, Idaho Falls Regional Office.

RE: Draft Staff Analysis for Nelson Ricks Creamery Wastewater Reuse Permit LA-00042-04

PURPOSE

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.400.04 *Application Processing Procedure – Contents of the Staff Analysis* for issuing wastewater reuse permits. Specifically, this staff analysis shall briefly state the principal facts and the significant questions considered in preparing the permit conditions, and a summary of the basis for the conditions with references to applicable requirements and supporting materials.

PROCESS DESCRIPTION

The Nelson Ricks Creamery Company (NRC) is located in Madison County in an agricultural area 1½ miles south of Sugar City and 2 miles northeast of Rexburg, Idaho. NRC produces a variety of specialty cheeses.

The wastewater treatment system consists of two aerated wastewater lagoons and approximately 60 acres of cropland used for the land application of wastewater. The plant, wastewater lagoons, irrigation ditches, and access roads occupy approximately eight acres of the total 68 acre site. Plant wastewater is primarily wash water with small quantities of whey permeate and cleaning chemicals. The wastewater flows from the secondary lagoon into the irrigation ditch and is applied to the three fields through flood irrigation. The land application farm has been leveled for flood irrigation.

NRC produces on average approximately 32.5 million gallons (MG) of wastewater in a given year. The wastewater treatment system was designed to handle 55 MG per year. Recent past practices have shown that approximately 33 – 57 percent of the wastewater is applied during the non growing season (NGS) with 43 – 67 percent applied during the growing season (GS). To meet crop water requirements during the growing season, wastewater is diluted with irrigation water prior to application. The ratio is approximately 1/3 wastewater to 2/3 irrigation water.

The pretreatment system for the facility consists of an 8.6 million gallon capacity, two cell lagoon treatment system. Both cells are aerated. This aeration is done primarily for odor minimization. The wastewater is then land applied via flood irrigation to the 60 acres of cropland.

SUMMARY OF EVENTS

1978: plans and specifications for a lagoon and land application wastewater disposal facility were approved by the Idaho Division of Environment. Previous wastewater disposal at the facility included a failed subsurface disposal system, followed by ditch disposal (flood irrigation) which was deemed unsatisfactory by the Division of Environment. Flood irrigation began in 1977.

1980: an inspection of the facility reported two lagoons, with the first aerated. Wastewater is mixed with

irrigation water and land applied via flood irrigation.

1990: the initial wastewater land application permit was issued to the facility. The process consists of 2 lagoons, with only the primary lagoon aerated, and land application to 60 acres via flood irrigation. Wastewater 'from the processing of cheese and supernatant from the whey concentrate' are treated via the lagoons; whey is restricted from land application. The permit also restricted land application of wastewater (previously applied to neighboring fields) to permitted acreage.

1995: an inspection report cited 35,000 gallons per day of wastewater generated.

1996: a facility inspection recommended accurate flow measurement devices for the facility, and a reduction in non-growing season hydraulic loading (26.5 million gallons in 1995).

The permit renewal application described wastewater as 'primarily wash water with small quantities of whey, cheese curds, and cleaning chemicals. Liquid resulting from whey concentrating also discharged into the lagoon.' Wastewater volume was 30.7 million gallons; land application volume was 27.4 million gallons. Irrigation water was blended in the irrigation ditch with wastewater at a ratio of 70% ditch water and 30% wastewater.

Permit renewal LA-000042-02 was issued in 1996. Permit specifics included the following hydraulic loading limits: 1) 55 million gallons annually; 2) the irrigation water requirement (i.e. – the IWR as the growing season limit); and, 3) 16.1 million gallons during the non-growing season.

1997: a permit modification required the submittal of a nuisance odor management plan in response to community odor complaints.

2000: both lagoons were equipped with aerators.

2002: Nelson Ricks Creamery utilized pollution prevention by changing chemical cleaners to solutions with lower phosphate content, and by minimizing use of one particular high phosphate cleaner. Phosphate use was projected to reduce from 3600 lb/yr (60 lb/ac) to 1400 lb/yr (23 lb/ac).

2003: permit renewal LA-000042-03 was issued.

REVIEW OF COMPLIANCE ACTIVITY STATUS

An updated Plan of Operation (Compliance Activity (CA) 042-01) was submitted in 2005 and approved in 2007.

An updated Nuisance Odor Management Plan (CA-042-02) was submitted in 2005 and approved in 2007. The original nuisance odor management plan was written in 1997 in response to community odor complaints. The frequency of odor complaints has reduced since that time, most likely due to the installation and full-time use of aerators in the lagoons. Complaints since 1997 are primarily due to odors generated during spring turnover of the ponds. Several complaints to a county commissioner in 2006 resulted in a DEQ inspection. The inspection was inconclusive but recommended milk truck rinsate be confined to truck bay drains (which drain to lagoon treatment).

The requirement to measure the sludge depth in primary wastewater treatment lagoon (CA-042-03) was submitted in 2003 and approved in 2003. The mean sludge depth of 0.18 inches was deemed by the DEQ as insignificant, and the requirement for a Waste Solids Management Plan was withdrawn.

The Well Location Acceptability Analysis, including a well log search to locate potentially applicable wells (CA-042-04), was submitted and approved in 2005.

An updated Buffer Zone Plan (CA-042-05) was submitted in 2005 and approved in 2007.

Seepage test results (CA-042-06) were submitted and approved in 2003.

The TDS ground water analyses (CA-042-07) was submitted in 2002 and approved in 2005. The DEQ deemed a TDS management plan as not required at that time.

The pre-application conference (CA-042-08) was conducted on August 8, 2007.

PERMIT RENEWAL COMPLIANCE ACTIVITIES

Compliance Activity CA-042-01 is intended to implement the buffer zone mitigation measures as described in the September 14, 2005 facility Buffer Zone Plan. The mitigation measures are necessary due to circumstances arising from the facility establishment prior to current buffer zone regulations, including inadequate buffer distances to features of concern.

Compliance Activity CA-042-02 requires seepage tests on both lagoons, and is a standard permit requirement for facilities utilizing lagoons for wastewater treatment or storage.

DESCRIPTION OF WASTEWATER TREATMENT AND REUSE SYSTEM

The following table summarizes the projected design conditions for the Nelson Ricks reuse facilities.

Average wastewater flow (gpd)	**Maximum wastewater flow** (gpd)	**Storage capacity** (MG)	**Wastewater land applied** (MG)	**Land application area** (acres)
150,000	260,000	8.6	55	60

SITE CHARACTERISTICS

The site rests on a relatively flat area underlain by thick, late Quaternary aged alluvial deposits. These deposits consist of interbedded clay, sand, and gravel. Drillers' logs indicate that the thicknesses of these deposits at the site are more than 133 feet. South of the site, the Rexburg bench slopes upward to the south. This bench is composed of the Quaternary aged Huckleberry Ridge Tuff, a rhyolitic, welded, ash-flow tuff. Silty loess deposits overlie the tuff on the bench (Mitchell and Bennett, 1979). It appears that the tuff dips northward, and underlies the site at depth, but is concealed by the alluvial deposits. Drillers' logs show the tuff underlying shallow alluvium and soils immediately south of the site.

Drillers' logs indicate basalt underlying the alluvial deposits at a depth of approximately 70 feet north of the site. The alluvial deposits appear to be thickest directly beneath the site, most likely because of the close proximity of the South Teton River. The soil types and soil depths make this a favorable site for wastewater land application. The uppermost groundwater in the vicinity is unconfined in the alluvial deposits. Depth to

standing water ranges from 20 to 40 feet below ground surface. The most prolific water bearing units are the sand and sandy gravel beds, with non-significant amounts of water found in the interbedded clayey sands and gravels. The presence of groundwater varies in areas where the wells penetrate the tuffaceous formations, and is likely dependent on the fracture porosity of these volcanic deposits.

Wastewater Quantity and Quality

Three year averaged effluent concentrations (2005 – 2007) and their associated loading rates are shown below for both the facility design wastewater flow of 55 million gallons per year, and the three year averaged (2005-2007) wastewater flow of 25.8 million gallons per year.

Constituent	**Effluent Concentration** (mg/L)	**Loading Rate at Design Flow of 55 MG/yr**	**Loading Rate at 3 Year Average Flow of 25.8 MG/yr**
COD	293	10.5 lb/acre*day	4.9 lb/acre*day
TDS	705	5381 lb/acre*year	2524 lb/acre*year
Total nitrogen	34	260 lb/acre*year	123 lb/acre*year
Total phosphorus	19	145 lb/acre*year	68 lb/acre*year

Projected Permit Limits and Hydraulic Loading Rates

The growing season for this area, based on alfalfa, will be from April 20 to Oct 15 (178 days). For permit purposes, the growing season (rounded to months) will be April 1 through October 31 or 214 days. Land application during the non-growing season shall be from November 1 through March 31 or 151 days.

The following equation was used for the hydraulic loading rate for the growing season:

$$IWR = [Cu - (PPT_e + \text{carry over soil moisture}) + LR]/E_i$$

Where:

IWR is the irrigation water requirement or the hydraulic loading rate for the growing season
Cu is the crop consumptive use
PPT_e is the effective precipitation
LR is the leaching rate
E_i is the irrigation efficiency

For permit purposes, the soil carry over moisture and leaching rate are assumed to be zero in calculating the IWR. A leaching rate of zero is used since soils in this area are not saline and need no additional hydraulic load for leaching.

CROP	**CU** (in.)	**PPT_e** (in.)	**E_i** (%)	**IWR** (in.)	**IWR** (MG)
Grass (alfalfa)	31.2	4	58%	46.9	77
Wheat	23.7	4	58%	34.0	55
Barley	23.7	4	58%	34.0	55

Data for wheat and barley are from "Estimating Consumptive Irrigation Requirements for Crops in Idaho, 1983" by R.G. Allen and C.E. Brockway.

The draft permit sets the growing season (GS) hydraulic loading limit at the IWR for the crop grown.

The IWR for grass will be approximately 46.9 inches (77 million gallons). At design wastewater flow rates, the wastewater available for reuse in the growing season will only be about 27 MG. Supplemental irrigation water will be required to meet the IWR for the proposed crop.

The guideline non-growing season (NGS) hydraulic application rate is equal to the soil available water holding capacity (AWC) minus the NGS precipitation plus the NGS ET (evapotranspiration). For this site, the NGS hydraulic loading rate of 9.7 ac*in./ac of wastewater was determined from a composite soil AWC of 11.4 inches, NGS precipitation of 5.5 inches (Western Regional Climate Center website, Rexburg Station No. 107644), and NGS ET of 3.8 inches (assumes 0.0251 in./day for Eastern Idaho, based on winter ET study at Kimberly by James L. Wright, 1993).

Application of 9.7 inches on 60 acres would set the NGS hydraulic limit at 15.8 million gallons. At current wastewater generation rates, staff anticipates NRC will be able to comply with this limitation. If wastewater generation rates increase, NRC will have to manage their pond system to provide NGS storage to achieve this limit.

No runoff will be allowed from any site or fields used for wastewater reuse except after a 25-year, 24-hour storm event or greater using the Western Regional Climate Center Precipitation Frequency Map, Figure 28 "Isopluvials of 25-YR, 24-HR Precipitation." For the NRC reuse site, the 25-year, 24-hour event is 2.0 inches. Best Management Practices (BMPs) for preventing runoff are listed in the Operation and Maintenance Manual.

Projected Permit Limits, Nutrients

Depending on crop yield, nitrogen uptake values for alfalfa are in the range 200 to 300 pounds per acre and 58 to 100 pounds per acre for wheat and/or barley. The nitrogen loading rates are 123 lb/acre at current conditions and 260 lb/acre at design conditions. Staff recommends permit limits for nitrogen at 150% of crop uptake.

Staff recommends that grass or alfalfa be grown as the primary crop on the wastewater reuse fields to maximize nitrogen uptake. The facility has applied over 150% of estimated crop nitrogen uptake for 3 of the last 5 years, due to the inadequate nitrogen uptake of barley.

The following table provides estimated crop uptake values for alfalfa, wheat, and barley.

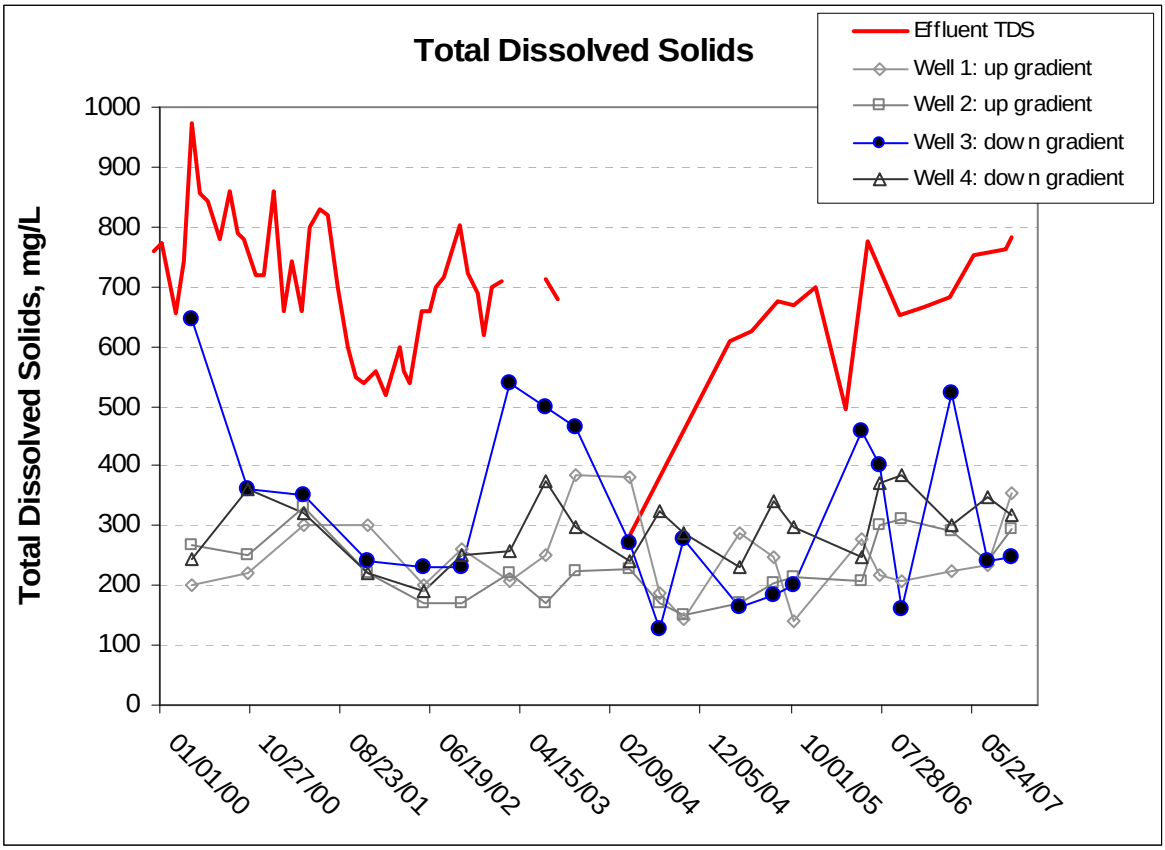
Crop	Constituent	Estimated Crop Uptake	150% of Estimated Crop Uptake
Wheat	Total nitrogen	58 to 88 lb/acre	87 to 132 lb/acre
	Total phosphorus	8 to12 lb/acre	12 to 18 lb/acre
Barley	Total nitrogen	70 to 100 lb/acre	105 to 150 lb/acre
	Total phosphorus	14 to 20 lb/acre	21 to 30 lb/acre
Alfalfa	Total nitrogen	200 to 300 lb/acre	300 to 450 lb/acre
	Total phosphorus	20 to 30 lb/acre	30 to 45 lb/acre

Source: Agricultural Waste Management Handbook, Part 651

GROUND WATER CONSIDERATIONS

The local hydrogeology, discussed in the April 4, 1997 CH2M Hill report, consists of interbedded alluvial deposits (clay, silt, sand and gravel) to a depth of at least 130 feet. This material is underlain by rhyolitic welded ash-flow tuff. The tuff unit is exposed south of the site and dips to the north; the depth to this unit beneath the site is not discussed in the report. The depth to water in the alluvium is 20 to 40 feet and the general ground water flow direction is toward the south. There is no discussion of ground water flow direction in the deeper tuff/basalt unit.

Groundwater quality was discussed in the May 2002 CH2MHILL *Groundwater Evaluation for the Nelson Ricks Creamery, Rexburg, Idaho*. The report evaluates semiannual sampling which initiated with monitoring well construction in 1997. Including sampling conducted through 2007, monitoring well No. 3 (MW 3) has surpassed the 500 mg/L ground water constituent standard 5 times in the last 10 years (graph, below). However, as determined by CH2MHILL, and also by DEQ groundwater gradient analyses, it appears that the high values typical in spring occur when ground water flows from west (off site) of the facility, and impacts MW 3. Therefore, corrective action is not recommended.



LAGOON SEEPAGE ANALYSES

The leakage performance standard set in the DEQ guidance is specified as 0.25 inches/day for all existing earthen and non-earthen wastewater treatment, storage, and conveyance structures. A seepage rate analysis of the lagoons at NRC was conducted in August 2003. The primary and secondary ponds tested at 0.085 in./day and 0.103 in./day, respectively, and met DEQ specifications for existing structures.

SURFACE WATER CONSIDERATIONS

The South Fork of the Teton River is located on the southern boundary of the property. Berms, buffer zones and BMPs need to be maintained to prevent the wastewater runoff from reaching the surface water.

BUFFER ZONES

The previous NRC permit required a Buffer Zone Plan as a compliance activity, and the plan was approved in 2007. The plan outlines several measures to mitigate insufficient buffer distances, but those measures have not been fully implemented at the time of this permit renewal. Therefore, a compliance activity for the implementation of the buffer zone plan mitigation measures has been incorporated into the permit renewal.

RECOMMENDATION

DEQ staff recommends issuance of the attached draft permit. The draft permit contains permit loading limits for nutrients, COD, and hydraulic loading rates. Monitoring and reporting requirements to evaluate system performance and to determine permit compliance have been specified.